Who Is Unemployed? Factors Affecting Unemployment Among Individuals with Doctoral Degrees in Science and Engineering

An SRS Special Report

Division of Science Resources Studies
Directorate for Social, Behavioral and Economic Sciences

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CONTENTS

Section *Page*

CONTENTS—CONTINUED

Section *Page*

KEY TERMS

Unemployed: Either on layoff or not employed but searching for work (during the four-week period prior to the reference date). NOTE: Individuals who are not working and not employed are defined as being out of the labor force. This group includes most individuals who are voluntarily not employed.

Labor Force: The labor force consists of unemployed plus employed individuals.

Unemployment Rate: The percent of the labor force that is unemployed.

Standardized Unemployment Rates: A number of techniques can be used to estimate the effect of one (independent) variable on another (dependent) variable, while "controlling" for other variables. The most straightforward technique is to construct a three-way table. For example, the average age of women in the doctoral labor force is less than that of men. To determine whether age and/or gender are related to the unemployment rate, it is logical to look at unemployment rates within sex-age groups (for example, men under age 30 compared with women under age 30, men aged 31–35 compared with women aged 31–35, etc.). Although cross-tabulations can be extremely helpful in understanding how two or more independent variables affect a single dependent variable, usefulness is limited by the fairly large sample sizes needed to estimate accurately subgroup unemployment rates. This becomes an especially serious problem when controlling for more than one variable. (For example, to understand whether observed differences in unemployment rates for individuals with disabilities can be explained by the fact that individuals with disabilities tend to be older than individuals without disabilities, and the fact that the incidence of disabilities tends to be higher among men than among women).

Instead of using cross-tabulations for control purposes in this report, a multivariate technique known as logistic regression analysis was used to estimate the simultaneous effect of a large number of variables on unemployment. The independent variables used in the logistic regression model are: degree field; place of employment or residence; years since receipt of Ph.D.; age when doctorate received; years of part-time experience; years of full-time experience; whether or not employed in April 1988; occupation in April 1988 (for employed individuals); employment sector in April 1988 (for employed individuals); parents' level of education; disability status; percent involuntarily out-of-field in the 1988 occupation; foreign research experience; marital status; interaction between gender and marital status; interaction between gender and whether children are in the home; interaction between gender and race/ethnicity; and interaction between marital status and race/ethnicity.

The logistic regression model was used to estimate the unemployment rate for a group of individuals who exhibited the same values on all of the independent variables except the one under consideration. For example, the observed unemployment rate for individuals with hearing disabilities was 3.0 percent, compared with a rate of 1.6 percent for non-disabled doctoral scientists and engineers; the respective standardized rates were 2.5 percent and 1.6 percent. Thus, factors listed above (other than whether the person had a hearing disability) explained some but not all of the observed difference between those with hearing disabilities and those without disabilities.

More detailed information about the standardization process is included in the Technical Notes. (See p. 47.)

EXECUTIVE SUMMARY

The primary purpose of this report is to explore empirically the factors affecting unemployment[1] among individuals with U.S. doctoral degrees in science and engineering in 1993. This information is of interest to individuals who are in—or considering entering—science and engineering, their advisors, and those responsible for programs serving them. The major questions addressed are:

How high were unemployment rates for doctoral scientists and engineers in the early 1990s?

- The 1993 unemployment rate of 1.6 percent was the highest rate observed in the biennial Survey of Doctorate Recipients (SDR) between 1973 and 1995. However, the April 1993 unemployment rate for those with science and engineering doctorates was substantially below the total population rate of 7.1 percent. The 1995 doctoral unemployment rate of 1.5 percent was virtually unchanged from the 1993 rate, even though the unemployment rate in the total labor force declined considerably to 5.7 percent.

How well can we predict unemployment rates in the doctoral science and engineering population?

- According to evaluations of past forecasts of the doctoral science and engineering job market, it is not now possible—and may never be possible—to forecast doctoral science and engineering unemployment rates with sufficient accuracy to be helpful in deciding whether or not to pursue doctoral-level careers in science and engineering, particularly in view of the long lead-time for obtaining this degree.

If we can't predict unemployment rates, why is it worth asking who is unemployed?

- Even though it is not possible to predict total doctoral science and engineering unemployment rates, generalizations can be made about unemployment in this population. For example, in the mid-1980s, an examination of doctoral science and engineering unemployment trends would probably not have led to an accurate prediction of the 1995 unemployment rate, but could have correctly predicted that doctoral scientists and engineers would continue to experience unemployment rates below those of the general population. It is reasonable to hypothesize that there is also some stability in the relative levels of subgroup unemployment rates over time.

Within the doctoral science and engineering population in 1993, who was most likely to be unemployed?

- Neither gender nor race/ethnicity had a statistically significant relationship with unemployment, when the other variables in this analysis were taken into account. However, having a hearing or mobility impairment or advanced age were associated with relatively high unemployment.

- Marital status and having children in the home have different effects on the unemployment status of the two sexes. For women, being married and having children were associated with relatively high unemployment rates; for men they were associated with relatively low unemployment rates.

- Education-related decisions are important predictors of unemployment:

  – Age at completing the doctorate is strongly associated with unemployment. When controlling for other relevant variables, the unemployment rate ranged from 0.6 percent for those who received doctorates before age 26 to 5.8 percent for those who received doctorates at age 40 or older.

  – Degree field is also important. In 1993, unemployment rates ranged from 0.6 percent for those with degrees in civil engineering to 2.5 percent for those with degrees in the geological and environmental sciences.

- Disruptions in full-time employment subsequent to receiving a doctorate increase significantly the chances of unemployment:

[1] The definition of unemployment used in this report is the standard Federal definition of not being employed and either being on lay-off or having sought work within the preceding four weeks. Individuals who are voluntarily without employment due to retirement, illness, family responsibilities, etc. are considered to be out of the labor force.

- Among those who were either unemployed or not in the labor force in 1988, the 1993 unemployment rate was 4.1 percent, compared to 1.5 percent for those who were employed in April 1988. The 1993 unemployment rate for those who had completed their doctorates before 1988, but were not employed in that year, was 9.6 percent—the highest unemployment rate observed in the study.

- Unemployment decreases with the number of years of previous full-time employment, when other variables are controlled for. However, prior part-time employment is associated with above-average unemployment rates.

- Other career-related variables found to be related to unemployment in 1993 were:

  - Among those employed in 1988, employment in the private-for-profit sector was associated with relatively high 1993 unemployment (2.6 percent). In contrast, prior employment in academia or the government was associated with low unemployment rates.

  - Occupation in 1988 was also a factor in predicting 1993 unemployment. The observed rates ranged from under 0.4 percent for postsecondary teachers in the physical sciences and engineering in 1988 to 2.9 percent for chemists (excluding postsecondary teachers). In general, those employed as postsecondary teachers in 1988 had lower unemployment rates than individuals in allied fields who were not postsecondary teachers.

  - Geographic location had a modest association with unemployment in the doctoral science and engineering population. Unemployment rates ranged from 0.3 percent in less populated states in the West North Central region (Iowa, North Dakota, South Dakota, Nebraska, and Kansas) to 2.8 percent in California in 1993. This association remained even after controlling for other relevant variables.

Have the factors affecting unemployment changed over time?

- There was a notable change between 1973 and 1993 in the association between gender and unemployment. In 1973, unemployment for men was 0.9 percent versus 3.9 percent for women; in 1993, the rates were 1.6 and 1.8 percent, respectively. This mirrors a similar decrease in the gender unemployment gap in the general population.

- Being an older member of the labor force is more strongly associated with unemployment in 1993 than in 1973.

- Although field of degree has a modest relationship with unemployment in both 1973 and 1993, there is little consistency between the two years on fields with the highest unemployment rates. This is consistent with traditional economic theory that indicates markets tend toward equilibrium over time. For example, when demand for a particular skill is high, compensation for the skill increases, which, in turn, encourages more individuals to acquire the scarce skill, thereby reducing or eliminating the scarcity.

- For the other two career-related decisions examined (sector and place of employment/ residence), there was little difference between 1973 and 1993 in either the strength of the associations or the pattern of the unemployment rates.

How well does the unemployment rate perform as an indicator of career outcomes compared to other possible indicators?

- The unemployment rate is viewed by economists as an indicator of the health of the economy. However, from the individual's perspective, unemployment is only one of several possible desirable or undesirable career outcomes, resulting from a combination of job opportunities, individual choices, and luck. For example, when individuals are unable to find suitable full-time employment, they may decide to search for employment that is part-time and/or inconsistent with the level or field of their training. Because individual choices and job opportunities are themselves a function of many of the factors examined in this report, it is not surprising that the association between unemployment and the alternate measures of labor market stress (involuntary part-time employment and involuntary out-of-field employment) is weak.